I (WE) CLAIM:

1. A method for forming a synthetic elevation aperture, the method comprising:

(a) acquiring at least first and second sets of ultrasound data, the first set of ultrasound data associated with a different elevation position than the second set of ultrasound data; and

(b) forming a beam across a synthetic elevation aperture as a function of the first and second sets of ultrasound data, the forming being a broadband process.

2. The method of Claim 1 wherein (b) comprises forming with delay-and-sum beamformation.

3. The method of Claim 2 wherein (b) comprises:

(b1) determining a first delay for a particular spatial location as a function of a first distance from an array to a first data set focal point and a second distance from the first data set focal point to the particular spatial location; and

(b2) applying the first delay to a first data sample from the first set of ultrasound data;

(b3) determining a second delay for the particular spatial location as a function of a third distance from the array to a second data set focal point and a fourth distance from the second data set focal point to the particular spatial location; and

(b4) applying the second delay to a second data sample from the second set of ultrasound data; and

(b5) summing the first and second data samples.

4. The method of Claim 2 wherein (b) comprises performing complex addition of coherent data as a function of data samples spatial location relative to a desired spatial location.

5. The method of Claim 1 wherein (b) comprises forming with frequency-domain beamformation.

6. The method of Claim 5 wherein (b) comprises:

(b1) applying a spatial-temporal Fourier transform;

(b2) interpolating in the frequency domain; and

(b3) applying an inverse spatial-temporal Fourier transform.

7. The method of Claim 1 wherein (a) comprises acquiring the first and second sets of ultrasound data, the first and second sets of ultrasound data being for elements of an array spaced along an azimuth dimension, and wherein (b) comprises performing two-dimensional beamformation along the elevation and azimuth dimensions.

8. The method of Claim 1 wherein (a) comprises acquiring beamformed data as the first and second sets of ultrasound data.

9. The method of Claim 1 wherein (a) comprises:

(a1) acquiring the first set of ultrasound data with a first aperture;

(a2) acquiring the second set of ultrasound data with a second aperture, the second aperture rotated within an elevation-azimuth plane relative to the first aperture, the rotation such that foci of the first and second apertures overlap.

10. A system for forming a synthetic elevation aperture, the system comprising:

a memory operable to store at least first and second sets of ultrasound data, the first set of ultrasound data associated with a different elevation position than the second set of ultrasound data; and

a beamformer operable to form a beam across a synthetic elevation aperture as a function of the first and second sets of ultrasound data, the forming being a broadband process.

11. The system of Claim 10 wherein the first and second sets of data correspond to receiving at different times, and wherein the beamformer is operable to perform delay-and-sum beamformation along an elevation aperture.

12. A method for forming a synthetic elevation aperture, the method comprising:

(a) configuring a multi-dimensional transducer array with a first interconnection of elements;

(b) acquiring a first set of ultrasound data as a function of the first interconnection;

(c) configuring the multi-dimensional transducer array with a second interconnection of elements, the second interconnection corresponding to a different elevation aperture than the first interconnection;

(d) acquiring a second set of ultrasound data as a function of the second interconnection; and

(e) applying a synthetic elevation aperture process to the first and second sets of ultrasound data.

13. The method of Claim 12 wherein (a) comprises switchably interconnecting elements of the multi-dimensional array to from a first macro element as a function of a first plane, and wherein (c) comprises switchably interconnecting elements of the multi-dimensional array to from a second macro element as a function of a second plane, the second plane at least partially having a different elevation position than the first plane.

14. The method of Claim 13 wherein the multi-dimensional array comprises a two dimensional array, and wherein (a) and (c) comprise rotating an aperture about a face of the two dimensional array.

15. The method of Claim 12 wherein the multi-dimensional array comprises one of a 1.25D, 1.5D and 1.75D array, and wherein (a) and (c) comprise varying an elevation aperture width.

16. The method of Claim 12 wherein (e) comprises beamforming with one of delay-and-sum beamformation and frequency-domain beamformation.

17. A system for forming a synthetic elevation aperture, the system comprising:

a multi-dimensional array of transducer elements;

a plurality of circuits operable to interconnect the elements into a plurality of macro elements;

a plurality of system channels operable to be connected with respective macro elements; and

a processor operable to apply a synthetic elevation aperture process to first and second sets of ultrasound data associated with different interconnections of the elements.

18. The system of Claim 17 wherein the multi-dimensional array comprises a two-dimensional array.

19. The system of Claim 17 wherein the multi-dimensional array comprises one of a 1.25D, 1.5D, 1.75D, and 2D array.

20. The system of Claim 17 wherein the processor comprises a beamformer operable to perform one of delay-and-sum and frequency-domain beamformation as a function of the first and second sets of ultrasound data, the first and second sets associated with different elevation apertures.

21. A method for forming a synthetic elevation aperture, the method comprising:

(a) rotating an aperture substantially within an elevation-azimuth plane;

(b) acquiring first and second sets of ultrasound data, the first set associated with a first position of the aperture and the second set associated with a second position of the aperture different than the first position; and

(c) applying a synthetic elevation aperture focusing process to the first and second sets of ultrasound data.

22. The method of Claim 21 wherein (a) comprises electronically rotating the aperture.

23. The method of Claim 21 wherein (a) comprises mechanically rotating the aperture.

24. The method of Claim 21 wherein (b) comprises acquiring ultrasound data beamformed within first and second planes associated respectively with the first and second positions of the aperture and wherein (c) comprises forming a beam with delay-and-sum beamformation of the first and second sets of ultrasound data along a dimension which does not lie either in the first nor the second planes.

25. The method of Claim 24 wherein (c) comprises:

(c1) determining a first delay for a particular spatial location as a function of a first distance from an array to a first data set focal point and a second distance from the first data set focal point to the particular spatial location; and

(c2) applying the first delay to a first data sample from the first set of ultrasound data;

(c3) determining a second delay for the particular spatial location as a function of a third distance from the array to a second data set focal point and a fourth distance from the second data set focal point to the particular spatial location; and

(c4) applying the second delay to a second data sample from the second set of ultrasound data; and

(c5) summing the first and second data samples.

26. The method of Claim 21 wherein (c) comprises forming a beam with frequency-domain beamformation.

27. A method for imaging with synthetic elevation aperture processing, the method comprising:

(a) acquiring first data representing a first volume in a first mode;

(b) generating at least a first image as a function of the first data;

(c) acquiring second data representing a second volume in a second mode, the second mode including synthetic elevation aperture processing, the second mode different than the first mode; and

(d) generating at least a second image as a function of the second data;

wherein (a) and (c) are performed in a same imaging session.

28. The method of Claim 27 wherein (a) comprises acquiring with a first elevation focus and a first elevation aperture step size and wherein (c) comprises acquiring with a second elevation focus wider than the first elevation focus and a second elevation aperture step size smaller than the first elevation aperture step size.

29. The method of Claim 27 wherein (c) comprises focusing with a larger angular spatial spectrum in elevation relative to an elevation focus of (a);

further comprising:

(e) beamforming in elevation with one of delay-and-sum and frequency-domain beamformation as a function of the second data.

30. The method of Claim 29 wherein (c) comprises focusing with one of a larger aperture, a smaller focal length in elevation relative to an elevation focus of (a) and combinations thereof;

31. The method of Claim 29 wherein (c) comprises defocusing in elevation relative to an elevation focus of (a).

32. The method of Claim 29 wherein (c) comprises acquiring with an aperture having a narrower elevation dimension than for (a).

33. A method for forming a synthetic elevation aperture, the method comprising:

(a) configuring a plurality of sub apertures with a first interconnection of elements;

(b) acquiring a first set of ultrasound data as a function of the first interconnection;

(c) configuring the plurality of sub apertures with a second interconnection of elements, the second interconnection corresponding to a different elevation aperture than the first interconnection;

(d) acquiring a second set of ultrasound data as a function of the second interconnection; and

(e) applying a synthetic elevation aperture process to the first and second sets of ultrasound data.

34. The method of Claim 33 wherein (a) and (c) comprise performing one of multiplexing, sub-array mixing and combinations thereof.